



Influence of forward light scattering induced by subsurface nanoglistenings of an intraocular lens on visual function

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Abstract

Purpose – To quantitatively assess forward light scattering (FLS) in eyes with subsurface nanoglistenings (SSNG), and its influence on visual function.

Materials and Methods – Forty-two eyes from 33 patients presenting increased surface light scattering due to SSNG on their intraocular lenses (IOLs), and 16 control eyes from 13 patients showing low surface light scattering were evaluated. SSNG was diagnosed based on the appearance of the IOL on the slit-lamp examination, and increased backward scattering (BLS) on the anterior IOL surface was confirmed by use of Scheimpflug images. Eyes were included in the study group if they presented mean values of BLS on the anterior IOL surface higher than 20 computer-compatible tape (CCT) units, and in the control group when this value was equal to or lower than 20 CCT. The following parameters were investigated: age, IOL type, IOL power, time elapsed since phacoemulsification procedure, FLS, BLS on the anterior and posterior IOL surfaces, visual function (visual acuity, and contrast sensitivity under photopic and mesopic conditions, with and without glare), modulation transfer function cutoff frequency, and Strehl ratio. Contrast sensitivity function was assessed with the OPTEC 6500 device (Stereo Optical), and the area under the log contrast sensitivity function (AULCSF) was calculated. BLS was evaluated using a Scheimpflug image system (EAS-1000; Nidek Company). FLS was assessed with a double-pass device, the Optical Quality Analysis System (OQAS II; Visiometrics) using the Optical Scatter Index (OSI) as a quantitative parameter. Simple correlation tests among the OSI, visual function, age,

time after surgery, IOL power, and BLS were performed. Also, multivariate analysis was carried out to verify the association between visual function and the other parameters.

Results – Time after surgery, BLS on both IOL surfaces, and OSI were significantly higher in the SSNG group than in the control group. The other parameters showed no significant differences between the groups. In the SSNG group, logMAR best-corrected visual acuity (BCVA) ranged from -0.176 to 0.045 (-0.06 ± 0.07 , mean \pm SD), with no patients showing BCVA worse than 20/25. Besides, OSI showed significant correlations with BCVA ($r = 0.4615$, $P = 0.0021$), AULCSF photopic conditions without glare ($r = -0.5459$, $P = 0.0002$) and with glare ($r = -0.5651$, $P < 0.0001$), AULCSF mesopic conditions without glare ($r = -0.4367$, $P = 0.0038$) and with glare ($r = -0.4965$, $P = 0.0008$). Multivariate analysis showed that the OSI was the only variable relevant to BCVA ($t = 3.147$, $P = 0.0033$), and to photopic and mesopic contrast sensitivities with glare ($t = 3.310$, $P = 0.0021$; $t = 2.616$, $P = 0.0129$, respectively). OSI and age correlated with contrast sensitivity without glare ($P < 0.05$).

Discussion – This is the first study quantifying FLS and showing its influence on the visual function of individuals presenting SSNG. FLS was significantly increased in the SSNG group, and those increases in FLS led to decreases in BCVA and contrast sensitivity within the normal range, while no correlation was observed in the control group. As the decrease in the visual function was within the normal limits, this study is in agreement with the general consensus that SSNG have no major clinical implications in visual function. However, it is important to consider that in particular cases of visual disturbances in patients no ophthalmic abnormalities other than SSNG, FLS might be the main contributor to the condition, and a complete evaluation of the quality of the

retinal imaging, including intraocular scattering data, would be advisable. Until the present moment, a great number of AcrySof IOLs have been implanted worldwide. Considering the fact that SSNG tend to increase with time in AcrySof IOLs, it is important to be aware of the correlation between FLS and visual function in those patients.

Conclusion – Eyes with SSNG showed increased levels of FLS. Although there was no severe deterioration in visual function, increases in FLS correlated with reductions in visual acuity and contrast sensitivity within the normal range.

Keywords: Subsurface nanoglistenings, Intraocular lens, Light scattering, Visual function